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SUBJECT Abstract of Electron Microscopic Investigations of the Structure of Palladium Films, by N V Demenev, N N Buinov, and M I Milutina

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Electron Microscopic Investigations of the Structure of Palladium Films

1. The purpose of the investigation of palladium films was to check the mechanism of formation and the rules previously obtained by the authors while working with films of platinum and gold [1,2].

2. Palladium films were obtained on the surface of aqueous solutions of $PdCl_2$ at temperatures between 9-10°C and between 18-20° by reduction with hydrogen gas. The velocity of film formation was controlled by alternating the concentration of the salt and the temperature[3]. The structure of the films was observed by an electron microscope, diffraction patterns were made with the same instrument and the grain size was calculated after evaluation of the patterns[1]. The average thickness of the films was determined by weighing.

3. The films of palladium as well as those of platinum and gold were very porous. The thickness of the films fluctuated between 25 and 90Å. It was difficult to observe the shape of single Pd crystals, but it seemed that they were cubical with a most frequent size of 50Å (sizes between 40 and 80Å were measured). X-ray investigations showed a size between 70 to 85Å[3]. The presence of stresses of the second type in the films could not be confirmed. These stresses were expected because of hydrogen absorption by palladium.

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4. Films of an average thickness of 20Å (Fig 1) were obtained at comparatively high reduction velocities in one minute. Not as uniform films were produced at lower velocities (Fig 2, reduction five minutes, thickness 25Å). On such films larger aggregates were also observed (Fig 3, reduction four minutes, average thickness 420Å). The needle like appearance and the distinctness of the film boundaries increased with the increase in the rate of reduction. At high rates the thickness of the films was 150Å and the grain size was not below 100Å. Evidently the large particles were acting as crystallization centres in the growth of the film (Fig 2). The authors have attempted to show that at low velocities of reduction (10°C, for one hour and 30 minutes) aggregates of a triangular shape were formed, having a thickness of 60A (Fig 4a).

5. The authors arrive at the conclusion that forces acting in coagulation are similar to those acting in crystallization.

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6. Institute of Physics of Metals, and
Institute of Chemistry and Metallurgy of
The Ural branch of the Academy of Sciences USSR.

References

1) N N Buinow, N V Demenev, A S Shur, and G G Fedorova, Dokl Akad Nauk 66, No 2 (1949).
2) N V Demenev, N N Buinow, and M I Milutina, ibidem 68, No 4 (1949).
3) N V Demenev, Works of Inst of Chem and Metallurgy UFAN USSR 1, 15 (1948).

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7. It is not said in the article what kind of palladium lattice the authors observed. It is known that the Pd-H absorption compound has a different lattice than the pure Pd. The description of the electron-microscopic observations is very unclear, partially because of the uncertainty of the experimental results, and partially because of the bad editing of the article. The conclusion of the authors concerning the nature of the acting forces in the film growth may be correct, although the conclusion is too general as then every phenomenon of absorption, adherence or even sticking together can be regarded as crystallization.

8. The article is of low quality from the experimental as well as from the theoretical point of view.

/Figures referred to in text are those contained in the original Russian text of Dokl Akad Nauk USSR, 63, 751-754 (1950)./

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